⑫ EUROPEAN PATENT APPLICATION

㉛ Applicant: **N.V. Nederlandsche
Apparatenfabriek NEDAP
Oude Winterswijkseweg 7
NL-7141 DE Groenlo (NL)**

㉜ Inventor: **Roosenschoon, Pieter Lieuwe
Hilteweg 37
NL-7104 BC Winterswijk-Meddo (NL)**
Inventor: **Loosveld, Serge Louis
Evertsenstraat 14
NL-7141 WB Groenlo (NL)**

㉞ Representative: **Smulders, Theodorus A.H.J.,
Ir. et al
Vereenigde Octrooibureaux
Nieuwe Parklaan 97
NL-2587 BN 's-Gravenhage (NL)**

㊾ **Method and device for automatically observing the behavior of animals.**

㊼ Method and apparatus for automatically observing the behavior of animals using at least one automatic identification unit. The identification unit can be mounted at several places in a space where domestic animals are housed, for instance the entrance of the milk parlor (14), a feeding station (10,11) or a drinking unit (12).

Thus the number of visits of an animal to a milk parlor (14), feeding station (10,11) and drinking unit (12) can be registered. At the same time, it is possible to register the time and the duration of each visit. Behavioral patterns can be recorded. By means of analysis software, deviations in the individual animal-specific pattern can be signaled and pronouncements can be made about deviations in the sphere of animal health and fertility.
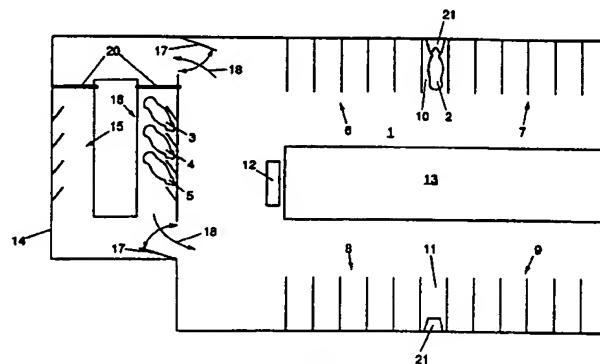
EP 0 624 313 A1

FIG. 1

The invention relates to a method and apparatus for automatically observing the behavior of animals.

Automatic recognition of animals is already employed on a large scale in stock farming.

For the automatic recognition of animals, typically use is made of a system which comprises a transmitter and a receiver or a combined transmitter/receiver (transceiver) and which generates an electromagnetic or magnetic field in one or more predetermined zones. The animals to be recognized are each fitted with an electronic or magnetic responder which contains a unique code for the animal in question. The code of such a responder can be detected by the receiver or transceiver as soon as the animal, and thus the responder of the animal, is located in one of the predetermined zones.

According to the known technique, the detection of an animal at a certain location is subsequently used to initiate a certain action, such as for instance the administration of feed, the automatic application of a milk claw of a milking machine, opening and/or closing one or more gates, measuring the animal's weight, et cetera.

A system for automatically recognizing, for instance, animals is generally described in applicant's French patent 7732938. Further, U.S. Patent No. 4,617,876 discloses a system especially adapted for automatically determining the weight of a cow after it has been electronically identified in a feed stall.

British patent application 2,076,259 discloses a different special system, which is adapted for determining the extent of activity of animals, such as cows. For that purpose, each animal has been fitted with a detector which detects the number of movements of the animal and converts them into a number. Together with an identification code, the number can be read out electronically by means of a transceiver. From a cow's motion activity as expressed by the number, it can be derived whether the cow is estrous.

With domestic animals, certain behavioral characteristics are known to proceed according to more or less fixed patterns. The behavioral patterns can be specific for an individual animal, but it is also possible that a pattern is normally the same for all animals. The behavioral patterns of animals are determined for an important part by the displacement patterns of the animals. Behavioral patterns occur both with animals that are kept solitary and with animals being housed in groups. Group housing has as a reinforcing effect that relations between animals (social order) can lead to certain behavioral patterns.

With pigs housed in groups, for instance, the order in which the pigs visit the feeding place is known to correlate with the relative rank of the animals in the social order in the event where the number of feeding positions is limited.

It is also known that deviations in the patterns can often be traced to fertility phenomena (in particular rut and heat) or health disorders (for instance lameness). Thus, a pig of high rank in the social order and always one of the first to come to the feeding place will, in case of illness, most likely be demoted to a lower rank and consequently be forced to eat later.

Because deviant animal behavior often leads to a lower production level, it is important that animals with deviant behavior be signaled at an early stage. For this purpose, in current practice the animals have to be checked visually for some time, several times a day.

The invention contemplates the provision of a method and apparatus for automatically observing the behavior of individual animals or, if so desired, groups of animals.

The invention has a number of advantages over the visual method. Firstly, deviant behavior can be ascertained sooner, secondly, signaling can be more reliable by virtue of the continuous character of the observation and, thirdly, the invention can lead to a significant saving of labor.

The object of the invention is to enable registration of animal behavior by means of automatic, for instance electronic, recognition, and to enable the signaling of deviant animal behavior, optionally with suitable software. Moreover, on the basis of the signaled deviations, a pronouncement may possibly be made about the cause of the deviation, in particular in the sphere of fertility and health.

As described above, this system is based on automatic, preferably electronic, recognition. A transceiver unit can register the visits to feeding places, milking positions, drinking stations or other places for every animal fitted with an identification label, which may for instance be of the type described in French patent 7732938.

In this way, the number of visits per unit time or period of time (24 hours, a week, etc.) can be recorded for each animal.

A method of the above-described type is characterized, according to the invention, in that in the space where animals are housed, at least one antenna device of an automatic identification device is arranged, which is capable of automatically identifying animals provided with an identification means as soon as they are located in a predetermined zone near the antenna device, and that the number of visits per animal or per group of animals to a predetermined zone per period of time is registered.

In the following, the invention will be further described with reference to the accompanying

drawings.

Fig. 1 schematically shows an example of a map of animal quarters where the invention can be applied;

Fig. 2 schematically shows, by way of example, a graphic representation of the possible number of visits per unit time of an animal to a specific station provided with a recognition unit;

Fig. 3 schematically shows an example of a frequency distribution curve of the number of visits per unit time;

Fig. 4 schematically shows an example of the duration of a visit of an animal to a specific station during a certain period of time;

Fig. 5 shows, by way of example, a frequency distribution curve of the duration per visit;

Fig. 6 shows, by way of example, a frequency distribution curve of the cumulative duration of a visit in a certain period of time;

Fig. 7 graphically shows, by way of example, the serial number of the first visit of an animal to a specific station measured over a number of days; and

Fig. 8 schematically shows an example of a frequency distribution curve of the rank of the first visit of an animal to a specific station over a number of days.

Fig. 1 schematically shows an example of a map of animal quarters which are suitable for the practice of the invention. The example shown concerns a stable 1 for milk cows. A few cows are schematically indicated at 2, 3, 4 and 5. The stable shown comprises a plurality of cubicles 6, 7, 8, 9; feeding stations 10, 11; a drinking station or drinking trough 12; a feeding floor 13 where the roughage for the animals is deposited. The stable further comprises a milking parlor 14 with a plurality of milk stands 15, 16, where the cows, such as the cows 3-5, can be milked. The milking parlor is connected with the rest of the quarters by way of passages 18, which, in this example, comprise gates 17.

In the example shown, the entrances to the milk stands are provided with antennas 20, which are connected with transceiver devices arranged *in situ* or elsewhere. Further, the feeding stations 10, 11 are each provided with a transceiver device 21, or with antennas therefor.

If desired, antennas of transceiver devices can be arranged at more points, for instance at the drinking trough(s), in the cubicles, at the exit of the milking parlor, etc.

Each animal whose behavior is to be investigated is provided with a suitable identification means, such as for instance an electronic responder, which generates a code signal associated with the animal in question as soon as the responder comes within reach of an antenna of a transceiver

device. The transceiver device can recognize the received code signal, so that it can be registered at what time and how long the animal in question is located at a specific place.

On the basis of these data, visiting frequencies (the number of visits to a specific station per unit time, for instance per day), displacement patterns, etc., can be determined for each animal, and, if desired, reproduced. For that purpose, the transceiver devices can be connected with a suitable computer. In that case, variations in the displacement patterns, visiting frequencies, etc., can also be determined and optionally reproduced.

The relative order in which the animals visit a certain station, as well as variations therein, can also be determined.

In Fig. 2 the number of visits per day of an animal to a specific station is depicted. The number of visits is indicated by B, the day number by A. The line L indicates the average.

Fig. 3 shows a frequency distribution of the number of visits per day (C) of an animal measured over a number of days. The probability is denoted by D. The probability of zero or twelve visits per day to the station in question is 0.1 in Fig. 3. By means of known statistical techniques for calculating variations and standard deviations and the like, a deviation can be signaled.

With the transceiver units described, the duration of each visit can be determined as well. On the basis of deviations in the average duration of a visit of an animal or in the total cumulative duration in a specified period of time, deviations of animals can be signaled. Examples are depicted in Figs. 4, 5 and 6.

Fig. 4 shows the duration of each visit (F) over a series of days (E). Both the length of each visit separately and the total duration of visits per day can be read from the diagram.

Fig. 5 is a frequency distribution of the duration per visit of an animal over a number of days. The probability is denoted by H, the duration in minutes by G.

Fig. 6 gives a frequency distribution of the cumulative duration per day over a number of days. K denotes the probability, J the duration in minutes.

In addition to the number of visits per unit time, it is also possible to determine, per transceiver unit or per group of transceiver units, the order of visits by animals from a specified time (see Figs. 7 and 8).

Fig. 7 gives the serial number (N) of the first visit an animal has made to the transceiver unit from a specified starting time over a number of days (M).

Fig. 8 gives a frequency distribution of the rank of the first visit of an animal to a specific station on

a number of days. The probability is denoted by R, the serial number of the first visit by Q.

Any deviations in the order can lead to the signaling of an animal with deviant behavior.

In order to increase the reliability of signaling or to enable the cause of a signaled deviation to be indicated, it may be useful to couple the above-described behavior recognition methods to animal-related quantities that are already conventionally measured, such as weight, feed uptake, milk yield, temperature, the conductivity of the milk, activity, water uptake, reproduction status, etc. Through such a coupling, signals can be generated at an earlier stage as well as acquire a higher reliability.

It is also possible, if so desired, to study and compare the behavior of animals per group. Since the age of each animal is known, the processing unit can, for instance, reproduce the behavioral features of young animals separately and compare them with those of other animals.

In the case of significantly deviant behavior of an individual animal, it is possible, if desired, for an automatic alarm signal to be given by means of a suitable signaling device, so that the stock farmer's attention is positively drawn to the deviant animal and, if necessary, measures can be taken.

Although electronic identification systems are very suitable for the practice of the invention, any other type of identification system can be used as well.

These and similar modifications are understood to fall within the scope of the invention.

Claims

1. A method for automatically observing the behavior of animals, characterized in that in the space where the animals are housed, at least one antenna device of an automatic identification device is arranged, which is capable of automatically identifying animals provided with an identification means as soon as they are located in a predetermined zone near the antenna device, and that the number of visits per animal or per group of animals to a predetermined zone per period of time is registered.

2. A method according to claim 1, characterized in that also the duration of the number of visits per period of time is determined, per visit and/or cumulatively.

3. A method according to claim 1 or 2, characterized in that the order in which the animals visit a predetermined zone per period of time is determined.

4. A method according to any one of the preceding claims, characterized in that the data relating to a period of time are compared with data relating to other periods of time, so as to enable deviations to be ascertained.

5. A method according to any one of the preceding claims, characterized in that the data obtained are combined with other available quantities regarding the animal which are conventionally determined, so as to detect deviations of the animal reagarding health and/or reproduction.

6. Apparatus for automatically observing the behavior of animals, characterized by one or more automatic identification devices which are adapted to automatically recognize animals provided with a suitable identification label in a number of predetermined zones in a space where animals are housed, and which generate a signal upon recognition of an animal; at least one registration unit which is coupled with the identification devices and stores the signals provided by the identification devices together with a time signal.

7. Apparatus according to claim 6, characterized in that the registration device is provided with or is coupled with a processing apparatus adapted to process the signals into statistical data and to compare them with previous signals.

8. Apparatus according to claim 7, characterized in that the processing apparatus is coupled with a signaling device adapted to signal a significant deviation between the signals being compared.

9. Apparatus according to claim 7 or 8, characterized in that the processing apparatus has one or more inputs to which other quantities regarding each individual animal are provided.

10. Apparatus according to any one of claims 7-9, characterized in that the processing apparatus is adapted to distinguish signals coming from animals belonging to different groups and, after the signals have been processed or not, to compare them with each other.

11. Apparatus according to any one of claims 7-10, characterized in that the processing apparatus is a computer which has been programmed with suitable software.

12. Apparatus according to any one of claims 7-11, characterized in that the registration device is part of a computer which also constitutes the processing apparatus.

13. Stable arrangement for the practice of the method according to any one of claims 1-5, characterized by a plurality of zones in which a plurality of automatic recognition devices can automatically recognize an animal provided with an identification means.

14. Stable arrangement according to claim 13, characterized in that the recognition devices are electronic identification devices and that the zones are formed by electromagnetic interrogation fields which in operation are formed by means of antenna devices of the identification devices.

15. Stable arrangement according to claim 13 or 14, characterized by at least one registering and processing apparatus, coupled with the identification device, which can register and process the recognition of an animal together with the zone where the recognition occurred and data about the time.
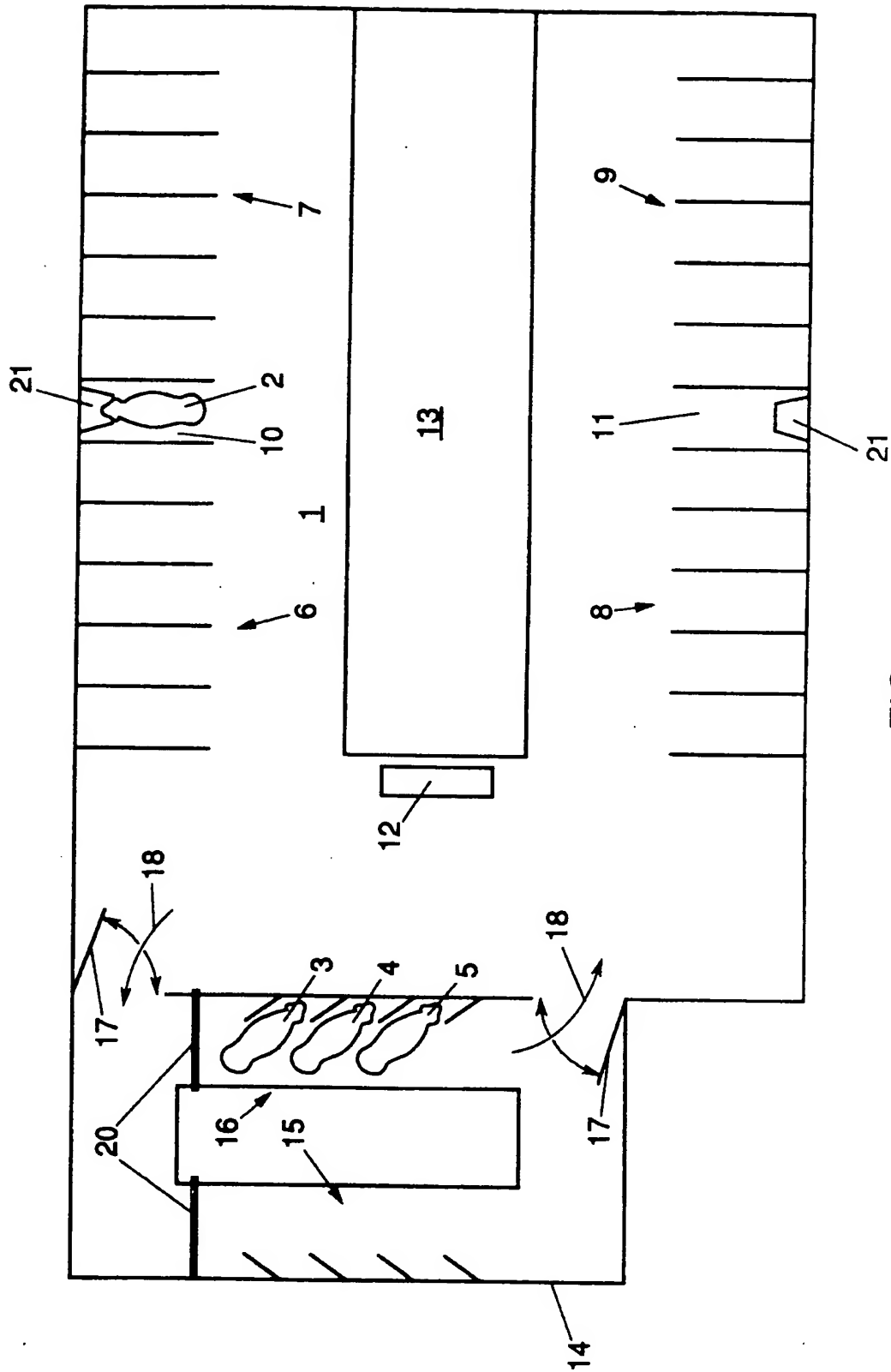
FIG. 1
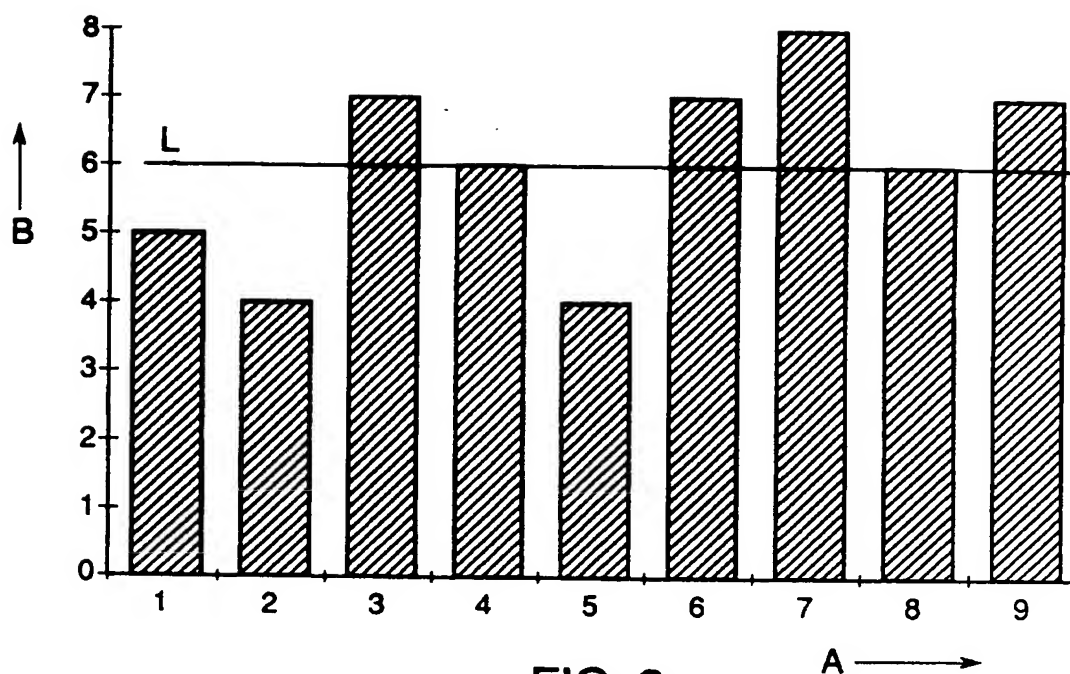
FIG. 2
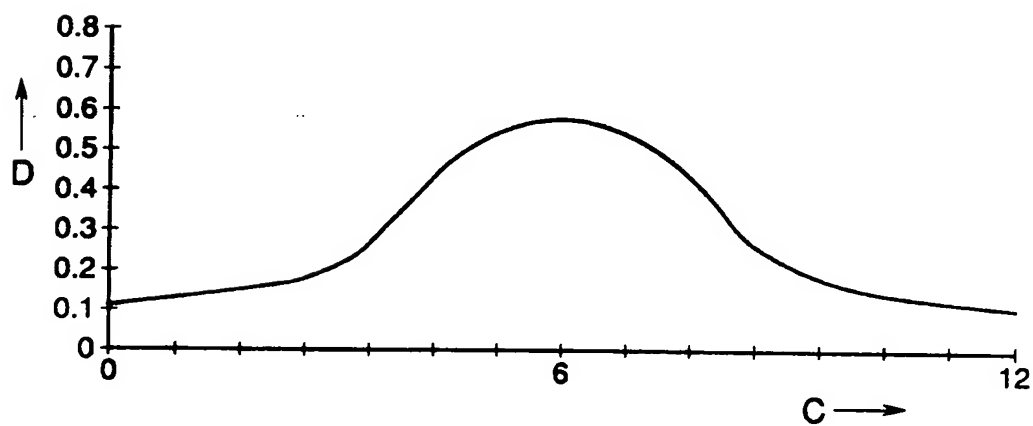
FIG. 3

FIG. 4
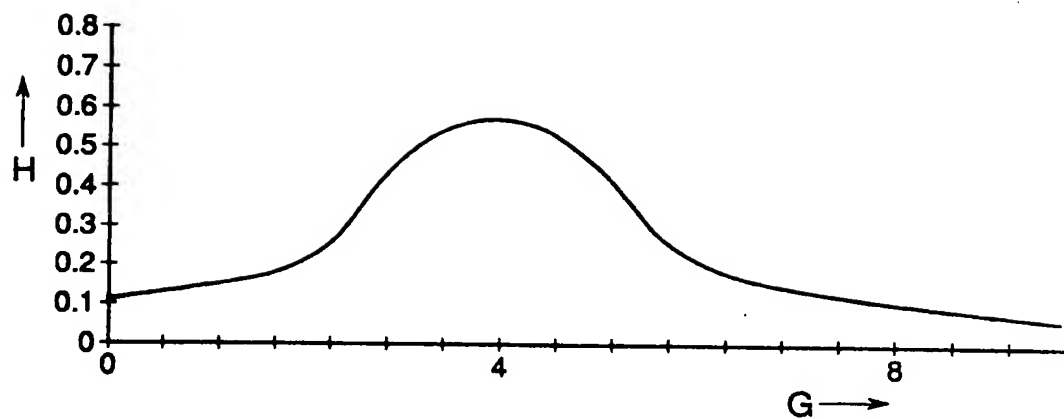
FIG. 5
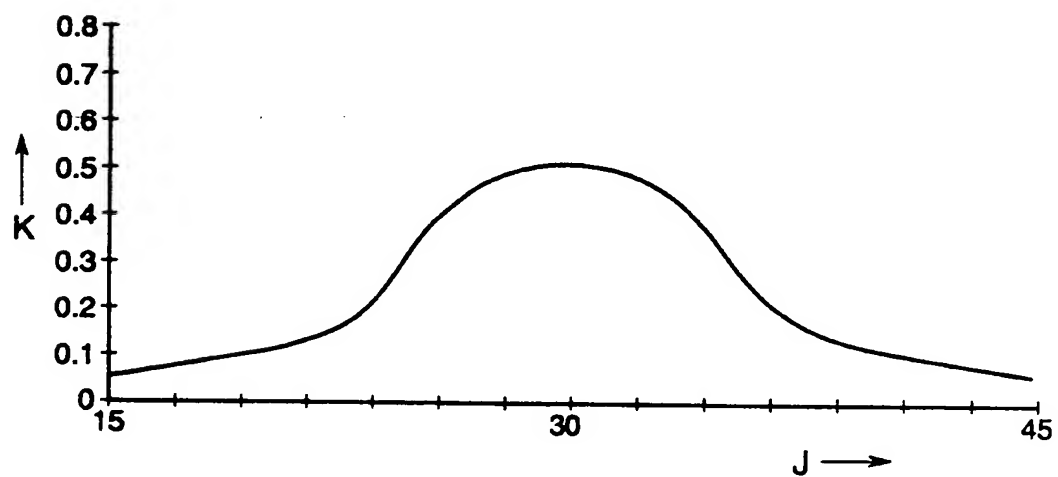
FIG. 6
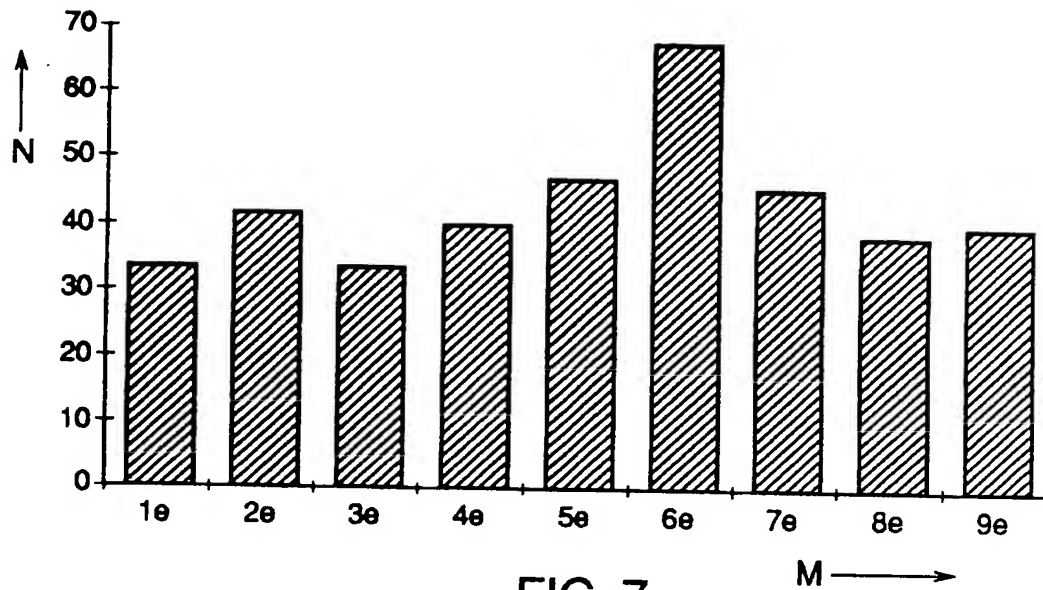
FIG. 7
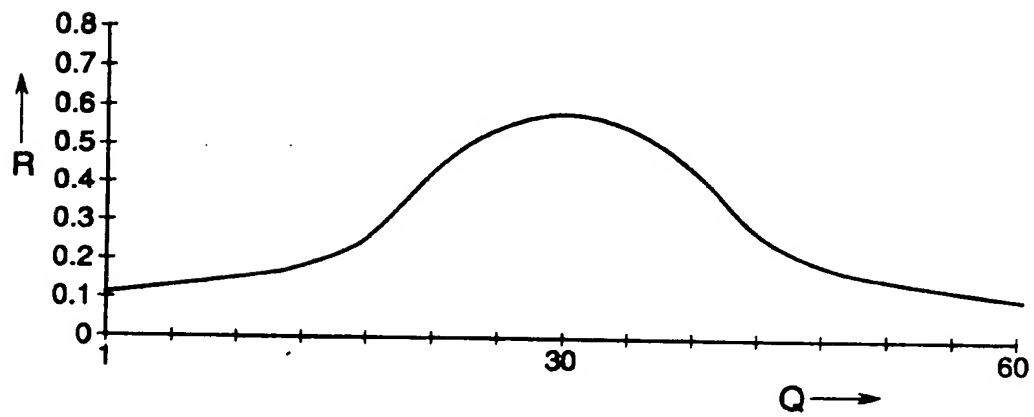
FIG. 8

9

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X,D	GB-A-2 076 259 (RODRIAN)	6-8,11, 12	A01K11/00 A01K29/00
A	* page 1, line 20 - line 59 *	1-5, 13-15	

A	US-A-4 463 353 (KUZARA)		

A	US-A-5 163 380 (DUFFY)		

A,D	US-A-4 617 876 (HAYES)		

TECHNICAL FIELDS SEARCHED (Int.Cl.5)
A01K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 August 1994	von Arx, V

EPO FORM 1503 03.82 (P04C01)